

1. Scope

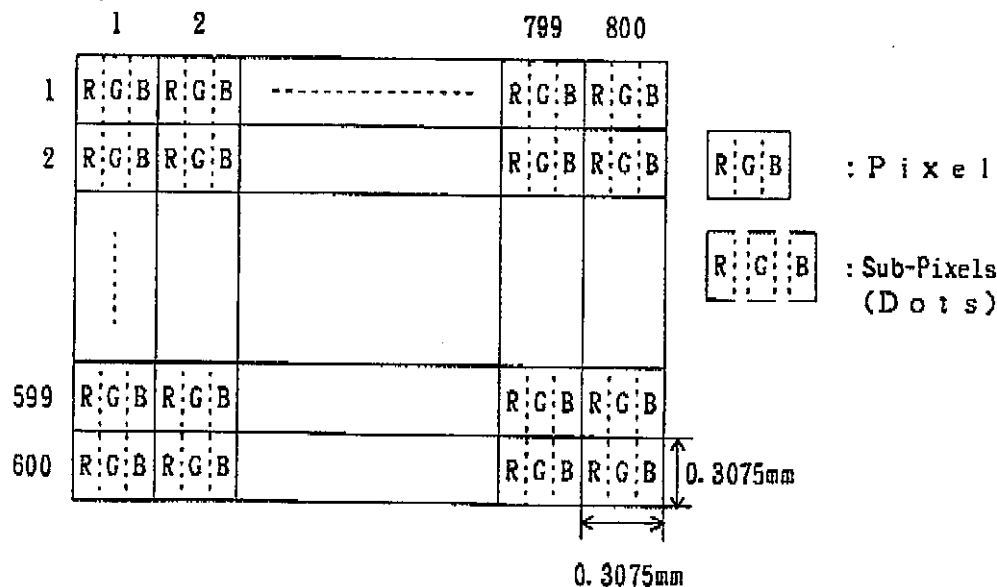
This specification is applicable to a diagonal 31cm size color TFT (Thin Film Transistor)-LCD Module designed for Personal Computer. Toshiba model name : "LTM12C268E".

2. Product Specifications

2.1 General Specifications

Item	Specifications
Display Mode	TN color(64 gray scales, 262k colors) Transmissive type, Normally white
Viewing Direction	6 o'clock(in direction of maximum contrast)
Driving Method	TFT active matrix
Input Signals	NCLK(clock), ENAB(compound synchronization signal) R5~R0(Red display data) G5~G0(Green display data) B5~B0(Blue display data)
Active Area	246.0(W) × 184.5(H) (mm)
Viewing Area	249.0(W) × 187.5(H) (mm)
Number of Pixels	800 (W) × 600 (H)
Pixel Pitch	0.3075(W) × 0.3075(H)(mm)
Pixel Arrangement	RGB vertical stripes
Surface Treatment	Anti-glare and hard coat 3H on LCD surface
Backlight	Single cold-cathode fluorescent lamp for sidelighting
Dimensional Outline	275.0×195.0×7.5max. (mm)

Note 1)



TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTM12C268E-121

2. 2 Absolute Maximum Ratings¹⁾

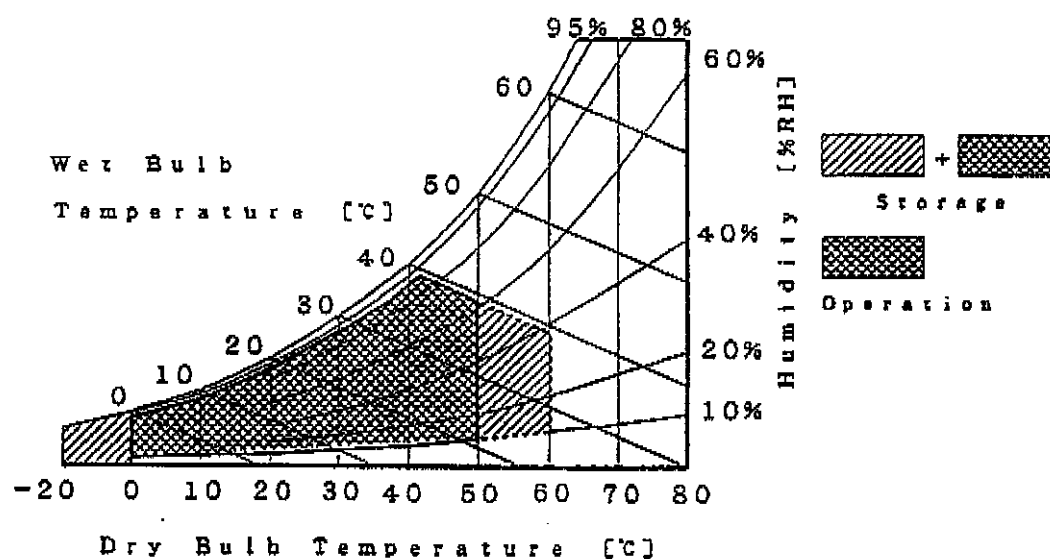
Item	Symbol	Min.	Max.	Unit	Checked Terminal ²⁾
Supply Voltage	V _{DD}	-0.3	+4.5	V	VDD-GND
Input Voltage of Signals	V _{IN}	-0.3	V _{DD} +0.3	V	R5~R0, G5~G0, B5~B0 NCLK, ENAB-GND
FL Driving Voltage	V _{FL}	0	2	kV _{rms}	
FL Driving Frequency	f _{FL}	0	100	kHz	
Operating Ambient Temperature ²⁾	T _{OP}	0	+50	°C	
Operating Ambient Humidity ²⁾	H _{OP}	10	90	%RH	
Storage Temperature ²⁾	T _{STG}	-20	+60	°C	
Storage Humidity ²⁾	H _{STG}	10	90	%RH	
Operating Temperature for Panel ³⁾	—	0	+60	°C	

Note 1) Do not exceed the maximum rating values under the worst probable conditions taking into account the supply voltage variation, input voltage variation, variation in part constants, and ambient temperature and so on. Otherwise the module may be damaged.

2) Wet bulb temperature should be 39°C Max, and no condensation of water. See figure below.

3) The surface temperature caused by self heat radiation of cell itself is specified on this item.

4) Refer to 2. 4. 4



2. 3 Mechanical Specifications

2. 3. 1 Weight

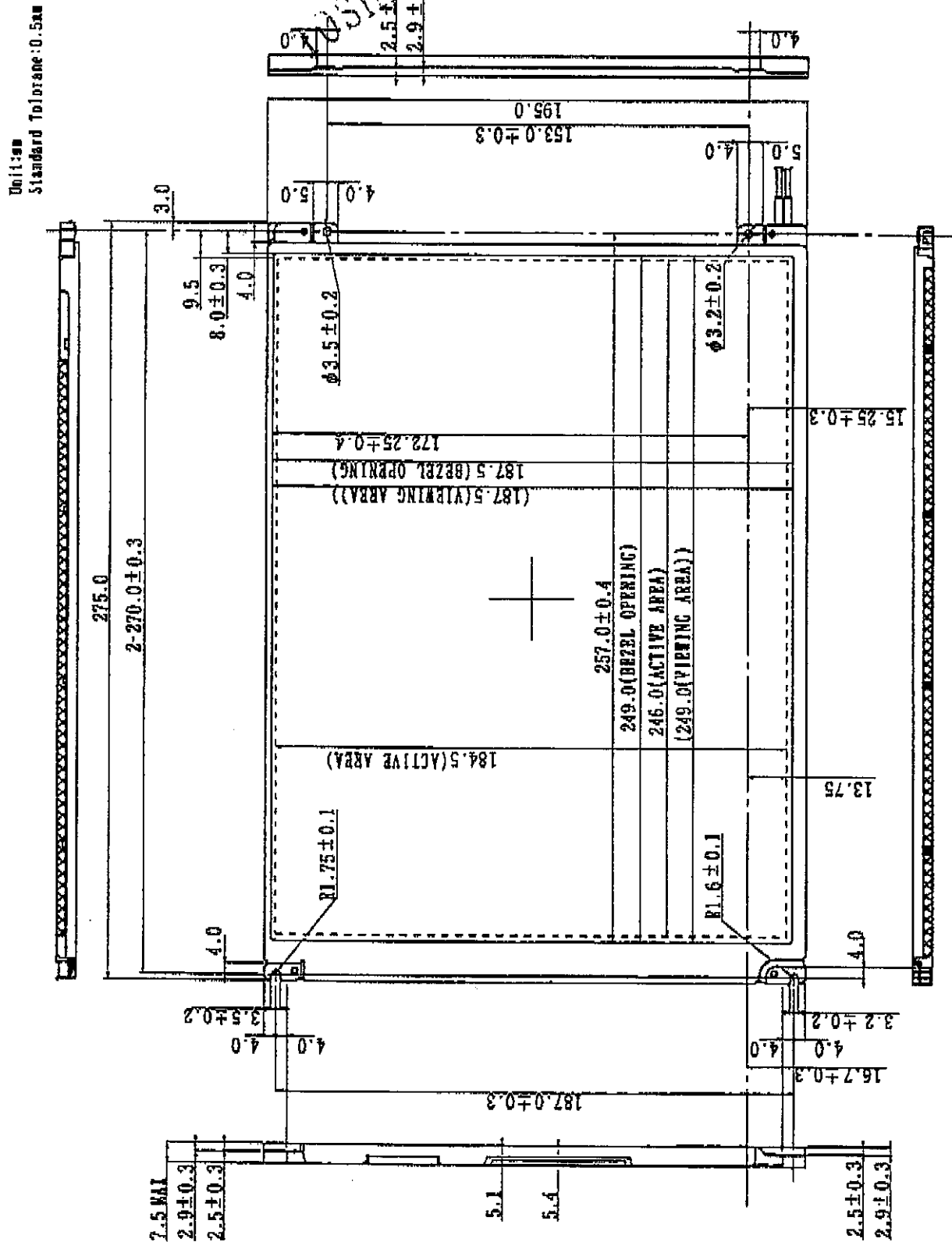
480±20 g

TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTW12C268E-121

2. 3. 2 Dimensional Outline



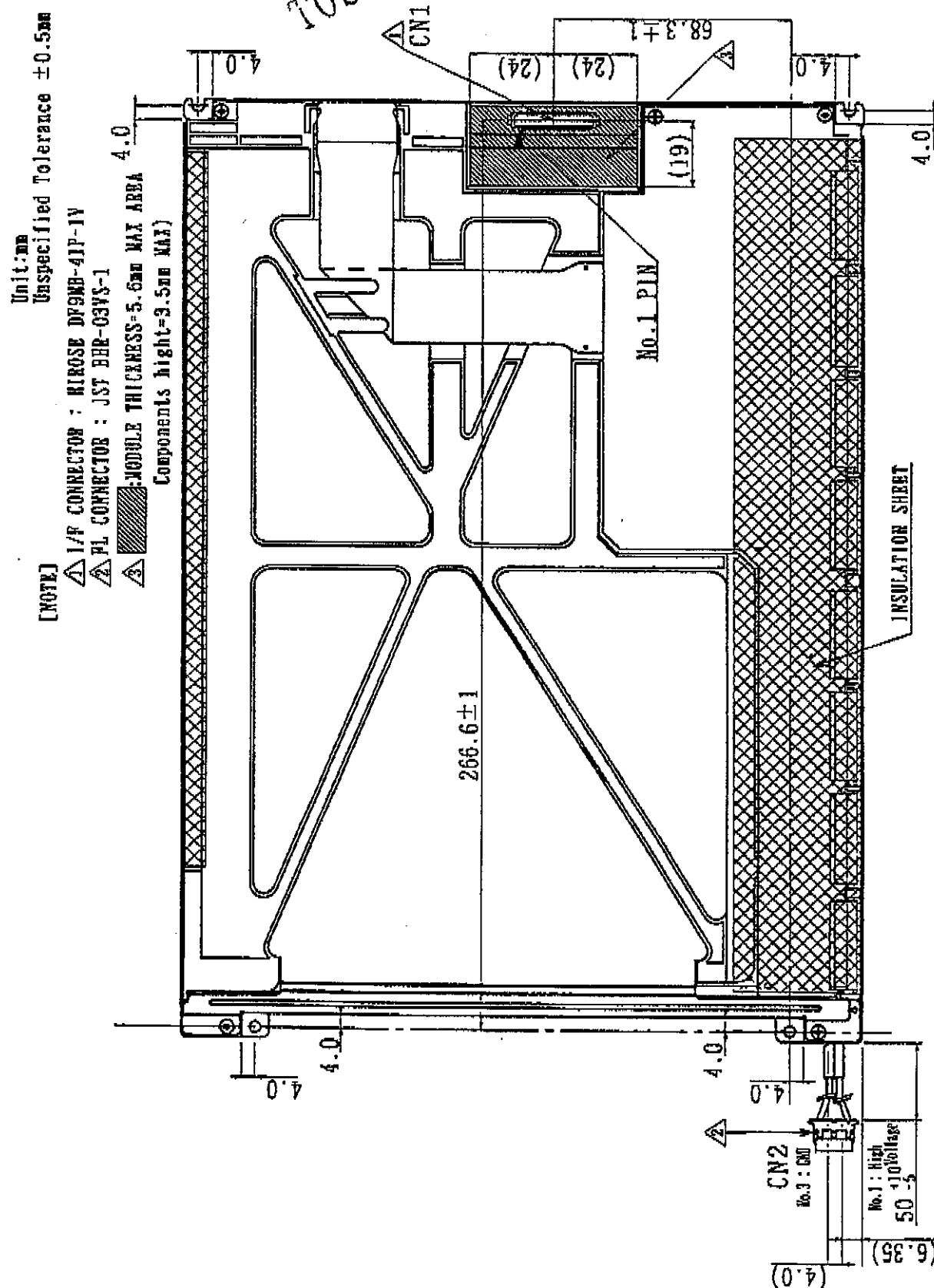
TOSHIBA

TOYOTA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date: 1997-04-14 No. NR-LTW12C268E-121

(Back figure)

TOSHIBA CONFIDENTIAL

**TOSHIBA**

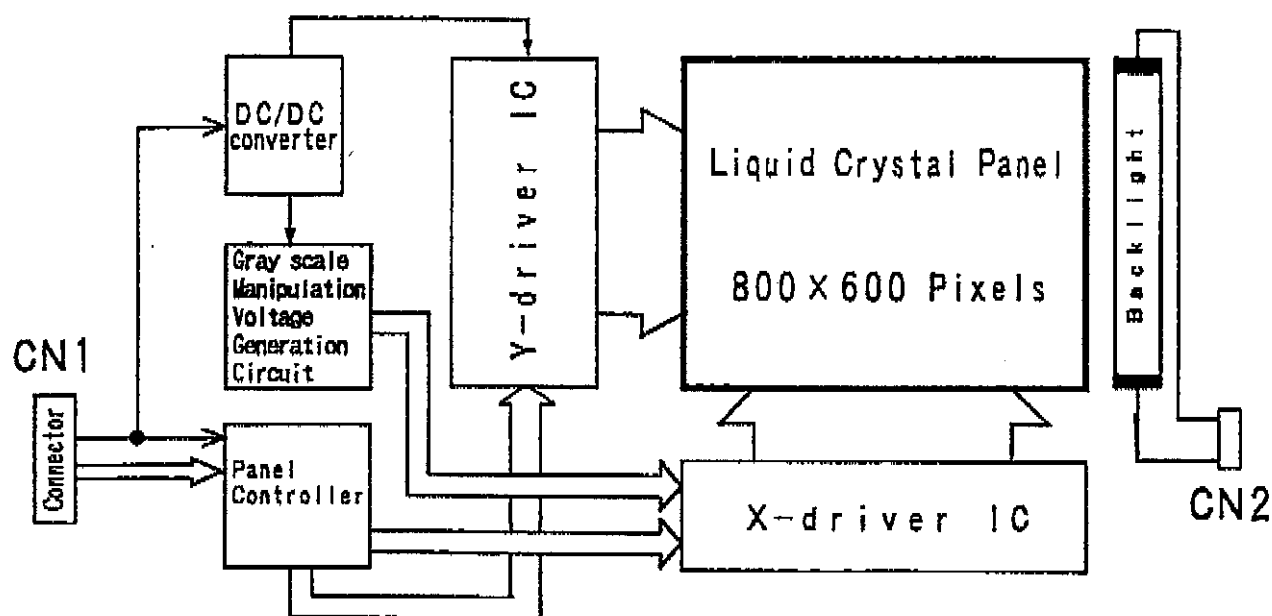
TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTM12C268E-121



2.4 Electrical Specifications

2.4.1 Circuit Diagram

**TOSHIBA**

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTW12C268E-12I

2. 4. 3 Timing Specifications

Item	Symbol	Min.	Typ.	Max.	Unit
Frame Cycle	t1	604×t3 —	625×t3 17.78	628×t3 17.86	— ms
Vertical Display Period	t2	600×t3	600×t3	600×t3	—
Horizontal Scanning Time	t3	844×t5 26.4	1024×t5 28.44	1056×t5 —	— μs
Horizontal Display Period	t4	800×t5	800×t5	800×t5	—
Clock Cycle	t5	25.0	27.78	—	ns
Clock "L" Time	t6	7.0	—	—	ns
Clock "H" Time	t7	7.0	—	—	ns
Set up Time	t8	3.0	—	—	ns
Hold Time	t9	10.0	—	—	ns

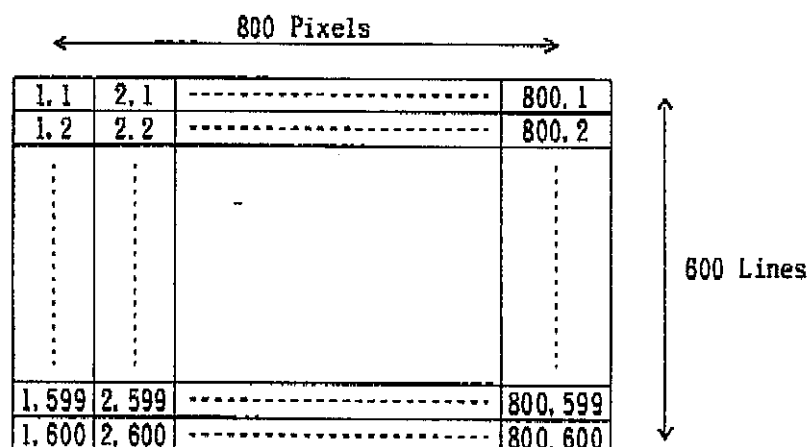
Note 1) When ENAB is fixed to "H" level or "L" level after NCLK's input, the panel is displayed as a black.

However, it may be occurred a flicker on the display.

Note 2) Don't fix NCLK to "H" or "L" level while the $V_{DD}(+3.3V)$ is supplied.

When NCLK is fixed to "H" or "L" level, while the normal operating signal isn't supplied to LCD panel, this condition results the degradation of the LCD panel display quality.

Note 3) Display Area Address is as follows.



TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTN12C268E-12I

2. 4. 4 Interface Connector

CN1 INPUT SIGNAL (DF9MB-41P-1V / HIROSE ELECTRIC CO., LTD.)

Mating connector: DF9MB-41S-1V or DF9-41S-1V series / HIROSE ELECTRIC CO., LTD.

Terminal No.	Symbol	Function
1	GND	
2	NCLK	SAMPLING CLOCK
3	GND	
4	NC ¹⁾	
5	NC ¹⁾	
6	GND	
7	GND	
8	GND	
9	R0 ²⁾	RED DISPLAY DATA (LSB)
10	R1 ²⁾	RED DISPLAY DATA
11	R2 ²⁾	RED DISPLAY DATA
12	GND	
13	R3 ²⁾	RED DISPLAY DATA
14	R4 ²⁾	RED DISPLAY DATA
15	R5 ²⁾	RED DISPLAY DATA (MSB)
16	GND	
17	GND	
18	GND	
19	G0 ²⁾	GREEN DISPLAY DATA (LSB)
20	G1 ²⁾	GREEN DISPLAY DATA
21	G2 ²⁾	GREEN DISPLAY DATA
22	GND	
23	G3 ²⁾	GREEN DISPLAY DATA
24	G4 ²⁾	GREEN DISPLAY DATA
25	G5 ²⁾	GREEN DISPLAY DATA (MSB)
26	GND	
27	GND	
28	GND	
29	B0 ²⁾	BLUE DISPLAY DATA (LSB)
30	B1 ²⁾	BLUE DISPLAY DATA
31	B2 ²⁾	BLUE DISPLAY DATA
32	GND	
33	B3 ²⁾	BLUE DISPLAY DATA
34	B4 ²⁾	BLUE DISPLAY DATA
35	B5 ²⁾	BLUE DISPLAY DATA (MSB)
36	GND	
37	ENAB	COMPOUND SYNCHRONIZATION SIGNAL
38	NC ¹⁾	
39	VDD	+3.3V POWER SUPPLY
40	VDD	+3.3V POWER SUPPLY
41	NC ¹⁾	

CN2 CCFL POWER SOURCE (BHR-03VS-1 / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.)

Mating connector: SM02(8.0)B-BHS-1 / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Terminal No.	Symbol	Function
1	VL	CCFL POWER SUPPLY (HIGH VOLTAGE)
2	NC ¹⁾	
3	GL	CCFL POWER SUPPLY (GND SIDE)

Note 1) NC TERMINAL is OPEN. (Don't Use)

Note 2) 262k colors are displayed by the combinations of 18 bits data. (See next page)

TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTN12C268E-121

TOSHIBA CONFIDENTIAL

2. 4. 5 Colors Combination Table

	DISPLAY	R5 R4 R3 R2 R1 R0	G5 G4 G3 G2 G1 G0	B5 B4 B3 B2 B1 B0	GRAY SCALE LEVEL
BASIC COLOR	BLACK	L L L L L L L	L L L L L L L	L L L L L L L	-
	BLUE	L L L L L L L	L L L L L L L	H H H H H H H	-
	GREEN	L L L L L L L	H H H H H H H	L L L L L L L	-
	LIGHT BLUE	L L L L L L L	H H H H H H H	H H H H H H H	-
	RED	H H H H H H H	L L L L L L L	L L L L L L L	-
	PURPLE	H H H H H H H	L L L L L L L	H H H H H H H	-
	YELLOW	H H H H H H H	H H H H H H H	L L L L L L L	-
	WHITE	H H H H H H H	H H H H H H H	H H H H H H H	-
GRAY SCALE of RED	BLACK	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	DARK ↑ ↓	L L L L L L H	L L L L L L L	L L L L L L L	L 1
		L L L L L H L	L L L L L L L	L L L L L L L	L 2
		:	:	:	L 3~
	LIGHT	H H H H L H	L L L L L L L	L L L L L L L	L 6 0
		H H H H H L	L L L L L L L	L L L L L L L	L 6 1
		H H H H H H	L L L L L L L	L L L L L L L	L 6 2
	RED	H H H H H H	L L L L L L L	L L L L L L L	RED L 6 3
GRAY SCALE of GREEN	BLACK	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	DARK ↑ ↓	L L L L L L L	L L L L L L H	L L L L L L L	L 1
		L L L L L L L	L L L L L H L	L L L L L L L	L 2
		:	:	:	L 3~
	LIGHT	L L L L L L L	H H H H L H	L L L L L L L	L 6 0
		L L L L L L L	H H H H H L	L L L L L L L	L 6 1
		L L L L L L L	H H H H H H	L L L L L L L	L 6 2
	GREEN	L L L L L L L	H H H H H H	L L L L L L L	GREEN L 6 3
GRAY SCALE of BLUE	BLACK	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	DARK ↑ ↓	L L L L L L L	L L L L L L L	L L L L L L H	L 1
		L L L L L L L	L L L L L L L	L L L L L H L	L 2
		:	:	:	L 3~
	LIGHT	L L L L L L L	L L L L L L L	H H H H L H	L 6 0
		L L L L L L L	L L L L L L L	H H H H H L	L 6 1
		L L L L L L L	L L L L L L L	H H H H H H	L 6 2
	BLUE	L L L L L L L	L L L L L L L	H H H H H H	BLUE L 6 3
GRAY SCALE of WHITE & BLACK	BLACK	L L L L L L L	L L L L L L L	L L L L L L L	BLACK L 0
	DARK ↑ ↓	L L L L L H	L L L L L H	L L L L L H	L 1
		L L L L H L	L L L L H L	L L L L H L	L 2
		:	:	:	L 3~
	LIGHT	H H H H L H	H H H H L H	H H H H L H	L 6 0
		H H H H H L	H H H H H L	H H H H H L	L 6 1
		H H H H H H	H H H H H H	H H H H H H	L 6 2
	WHITE	H H H H H H	H H H H H H	H H H H H H	WHITE L 6 3

Note 1) L : Low level voltage, H : High level voltage

TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTM12C268E-121

3. Electrical Specifications

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	2)
"H" Level Input	V_{IH}	$0.8V_{DD}$	—	V_{DD}	V	3)
"L" Level Input	V_{IL}	0	—	$0.2V_{DD}$	V	3)
FL Input Current	I_{FL}	2.5	3.5	4.5	mA _{rms}	4)
FL Driving Voltage	V_{FL}	480	530	580	V _{rms}	$I_{FL}=3.5\text{mA}_{rms}$ (Reference) 5)
FL Driving Frequency	f_{FL}	40	45	60	kHz	6)
FL Starting Voltage	V_{sFL}	1100	—	1600	V _{rms}	0°C 6)

Note 1) The module should be always operated within these ranges. The "Typ." shows the recommendable value.

2) Checked Pin Terminal : V_{DD}

(GND : $V_{SS}=0V$)

3) Checked Pin Terminal : R5~R0, G5~G0, B5~B0, NCLK, ENAB

(GND : $V_{SS}=0V$)

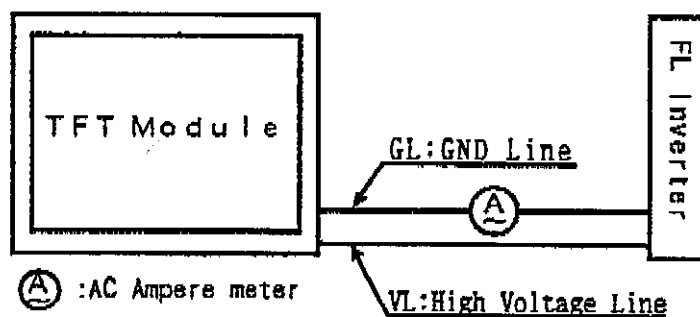
4) Checked Pin Terminal : VL-GL

5) Input FL starting voltage(V_{sFL})

should not be less than one second.

If it were less than one second, it may cause unstable operation of FL.

6) Measuring Method of I_{FL} :



4. Electrical Characteristics

4. 1 Test Conditions

Ambient Temperature : T. $25\pm5^\circ\text{C}$

Ambient Humidity : H. $65\pm20\%\text{RH}$

Supply Voltage : V_{DD} 3.3V

Input Signal : Refer to typical value in "2. 4. 3 Timing Specifications".

FL Input Current : I_{FL} 3.5mA_{rms}

FL Driving Frequency : f_{FL} 44kHz

4. 2 Specifications

Item	Symbol	Min.	Typ. 1)	Max.	Unit	Remark
Current Consumption	I_{DD}	—	230	350	mA	VDD Terminal Current

Note 1) The Typical value of I_{DD} is measured in the following pattern.

1. White
2. Yellow
3. Purple
4. Red
5. Light Blue
6. Green
7. Blue
8. Black

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---

TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTM12C268E-12I

Specification No. G970018-1996

Sheet 13

TOSHIBA CONFIDENTIAL

5. Optical Characteristics

5.1 Test Conditions

It is same as 4.1

The measuring method is shown in 1.2.

5.2 Optical Specifications

Item		Symbol	Conditions	Specifications			Unit
				Min.	Typ.	Max.	
Viewing Angle ¹⁾		θ	CR $\geq$ 10 $\phi = 180^\circ$ $\phi = 0^\circ$ $\phi = 90^\circ$ $\phi = -90^\circ$	10	—	—	deg.
				20	—	—	deg.
				30	—	—	deg.
				30	—	—	deg.
Contrast Ratio		CR	$\theta = 0^\circ, \phi = 0^\circ$	100	—	—	—
Response time		t_{ON}	$\theta = 0^\circ, \phi = 0^\circ$	—	—	50	m s
		t_{OFF}		—	—	50	m s
Luminance		L	$\theta = 0^\circ, \phi = 0^\circ$ Gray Scale Level=L63 (White)	50	70	—	cd/m ²
Luminance Uniformity		TUNF	$\theta = 0^\circ, \phi = 0^\circ$ Gray Scale Level=L63 (White)	55	—	—	%
Chromaticity	Red	R _x	Gray Scale Level:L63 $\theta = 0^\circ, \phi = 0^\circ$	0.52	0.59	0.66	—
		R _y		0.27	0.34	0.41	—
	Green	G _x	Ditto	0.25	0.32	0.39	—
		G _y		0.47	0.54	0.61	—
	Blue	B _x	Ditto	0.08	0.15	0.22	—
		B _y		0.09	0.16	0.23	—
	White	W _x	Ditto	0.28	0.33	0.38	—
		W _y		0.30	0.35	0.40	—

Note 1: Refer to "1.2. Measuring Method".

TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date: 1997-04-14 No. NR-LTW12C268E-121

6. Quality

6.1 Inspection AQL

Total of Major Defects : AQL 0.65 %

Total of Minor Defects : AQL 1.5 %

Sampling Method: MIL-STD-105D(Level II)

6.2 Test Conditions

1) Ambient Temperature : $25 \pm 5^\circ\text{C}$ 2) Ambient Humidity : $65 \pm 20\% \text{RH}$

3) Illumination : Approximately 500Lx under the fluorescent lamp

4) Viewing Distance : Approximately 30cm by the eyes of the inspector from the module

5) Inspection Angle : $\theta = 0^\circ$, $\phi = 0^\circ$

6.3 Dimensional Outline

The products shall conform to the dimensions specified in 2.3.2

Definition of Major and Minor defects are as follows.

Item	Description	Class
Important Dimensions	Dimensional outline, Dimensions between the mounting holes.	Major
Others	Dimensions specified in this specifications	Minor

TOSHIBA

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date: 1997-04-14 No. NR-LTM12C268E-12I



6. 4 Appearance Test

6. 4. 1 Test Conditions

1) Condition : Non-operating

6. 4. 2 Specifications

Item	Description				Class
PCB Appearance	* Pattern peeling snapping, electrically short.				Major
	* Repair portion on PCB is not covered by epoxy resin.				Minor
Soldering	* Cold solder joint, lead move when pulled				Major
Bezel, Frame, Connectors	* Distinct stain, rust or scratch.				Minor
Black and White Spots/Lines ^{1) 2)}	* Line width(mm)	Length(mm)	Acceptable count	Acceptable count	Minor
	$W \leq 0.03$		neglect		
	$0.03 < W \leq 0.1$	$L \leq 0.3$	neglect		
	$0.03 < W \leq 0.1$	$0.3 < L \leq 2.1$	$n \leq 4$		
	$0.03 < W \leq 0.1$	$2.1 < L$	0		
	$0.1 < W$		(Note 2)		
	* Average diameter(mm)	Acceptable count		$n \leq 10$	
	$D \leq 0.1$	neglect			
	$0.1 < D \leq 0.4$	$n \leq 4$			
	$0.4 < D$	0			
Polarizer Dents/Scratches ^{1) 3)}	* Line width(mm)	Length(mm)	Acceptable count	$n \leq 10$	
	$W \leq 0.01$		neglect		
	$0.01 < W \leq 0.05$	$L \leq 1.0$	neglect		
	$0.01 < W \leq 0.05$	$1.0 < L \leq 10$	$n \leq 4$		
	$0.01 < W \leq 0.05$	$10 < L$	0		
	$0.05 < W$		(Note 3)		
	* Average diameter(mm)	Length(mm)	Acceptable count	$n \leq 10$	
	$D \leq 0.1$		neglect		
	$0.1 < D \leq 0.4$	$L \leq 1.0$	$n \leq 4$		
	$0.1 < D \leq 0.4$	$1.0 < L$	0		
	$0.4 < D$		0		

Note 1) Inspection area should be within viewing area. (249.0x187.5mm²)Note 2) Lines which are bigger than 0.1mm ($0.1 < W$) shall be judged by "Average Diameter".Note 3) Scratches which are bigger than 0.05mm ($0.05 < W$) shall be judged by "Average Diameter".

$$\text{Average Diameter } D = \frac{a + b}{2}$$

**TOSHIBA**

TOSHIBA CORPORATION LIQUID CRYSTAL DISPLAY DIVISION

Date:1997-04-14 No. NR-LTM12C268E-121